TECHNICAL EVALUATION OF THE IEEs FOR OFFSHORE PETROLEUM EXPLORATION

North of Vancouver Island

A REPORT PREPARED BY THE CANADA OIL AND GAS LANDS ADMINISTRATION AND THE BRITISH COLUMBIA MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES

VICTORIA

January 17 & 18 1984

Province of British Columbia

Canada

The Westcoast Offshore Panel,
789 West Pender Street,
Vancouver, British Columbia.
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Dear Panel:

This document is a summary of the Technical Evaluation of the Initial Environmental Evaluations (IEEs) which were prepared by Petro-Canada Inc. and Chevron Canada Resources Limited in support of a panel review of renewed petroleum exploration in the offshore north of Vancouver Island.

In order to facilitate a rigorous scientific and technical evaluation of the IEEs, the Canada Oil and Gas Lands Administration and the British Columbia Ministry of Energy, Mines and Petroleum Resources invited approximately 80 scientists to participate in the Technical Evaluation. Environmental and social scientists from both federal and provincial governments attended. The meeting was held January 17th and 18th, 1984 at the Institute of Ocean Sciences. This report is a summary of the expert opinions expressed at the Technical Evaluation.

The consensus of the Technical Evaluation was that the companies had generally fulfilled the expectations for the IEEs. On this basis, the Canada Oil and Gas Lands Administration and the Ministry of Energy, Mines and Petroleum Resources are pleased to accept the documents prepared by the two companies to serve as the primary data base for the panel review. We hope that the analysis of the IEEs and the recommendations of the workshops in the Technical Evaluation will assist the panel in its deliberations.

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Section I

1. Introduction

In September 1983, the governments of Canada and British Columbia signed an Agreement which provided for a joint Canada-British Columbia public review of the environmental and directly related socio-economic effects of offshore petroleum exploration off the west coast of British Columbia north of Vancouver Island. Chevron Canada Resources Ltd. and Petro-Canada Inc. are the two companies that have expressed an interest in resuming exploration off the west coast.

Under the terms of the Agreement, which is attached as Appendix A, the Canada Oil and Gas Lands Administration (COGLA) of the federal Ministry of Energy, Mines and Resources, and the British Columbia Ministry of Energy, Mines and Petroleum Resources (MEMPR) shared two initial responsibilities: to evaluate the environmental and socio-economic data base to be used in the review, and to establish the Terms of Reference for the public review, the latter in consultation with the federal Environmental Assessment Review Office and the provincial Ministry of Environment. The first task, as outlined in paragraph 4 of the Agreement, was to coordinate a Technical Evaluation of the Initial Environmental Evaluations (IEEs)

prepared and submitted by the two companies. Under the terms of the Agreement, land claims, energy policy and jurisdictional issues, as well as production scenarios were excluded from the review.

The IEEs were expected to contain an adequate description of the exploration project, descriptions of natural and socio-economic resources and their current and potential utilization, an outline of possible biophysical and directly related socio-economic effects, their significance, and proposed measures to mitigate or prevent such effects.

The Technical Evaluation took place on January 17 and 18, 1984 at the Institute of Ocean Sciences near Sidney, British Columbia. The Technical Evaluation was designed as the key federal and provincial government forum, prior to the formal Panel review, to evaluate the scientific merit of the baseline information in the IEEs and to provide comment on how correctly the baseline information had been interpreted in the assessment of environmental effects of proposed offshore exploration. An outcome of the Technical Evaluation was the identification of data inadequacies and recommendations as to the merit of the IEEs to serve as the primary information base for the formal Panel review.

Representatives from the federal and provincial governments were identified and invited to participate in the Technical Evaluation. Participants were given three months to review the IEEs. A list of participants is attached as Appendix B.

Participants were requested to consider the IEEs in terms of general adequacy, competence, and completeness to provide the required background information for the public review. Specifically, the participants were asked to address a set of six questions on the quality and character of the documents, and to comment in other areas where appropriate.

The six questions were:

1. Have the known generic effects of seismic and exploration activities been characterized? For example, the known effects of hydrocarbons on fish, plankton, sea birds, etc.

2. Have those elements of the environment which are identified in question 1 to be potentially affected by hydrocarbon activity, been adequately described for the Queen Charlotte Sound, Hecate Strait, and Dixon Entrance areas?

3. Have the levels of impact on the environment identified in question 2 been adequately evaluated? For example, were the assumptions leading to a prediction of levels of impact reasonable?

4. What are the information gaps and how might planning accommodate the existence of those gaps?

5. Do the IEEs adequately assess the scale and probability of accidental occurrences?

6. Do the IEEs provide an adequate description of measures, abatement practices, contingency plans, operational practices or other means to control and abate deleterious effects from accidental or routine occurrences?

Technical Evaluation

Chevron and Petro-Canada initiated proceedings by presenting overviews of their respective IEEs. Participants were subsequently divided into six workshop groups each addressing a specific topic area. The companies were requested to provide resource personnel who were familiar with the contents of the IEEs and offshore exploration activities.

Resource persons from both the federal and provincial governments were also available to respond to questions on procedures, techniques, policy, and operational matters as requested by the workshop groups. Six workshop groups were formed:

- Coastal Geology and Geomorphology, Surficial Geology, Petroleum Geology and Seismicity
- Oceanography and Meteorology
- Plankton, Fish and Benthos
- Birds and Mammals
- Socio-community: Community, Services, Infrastructure
- Socio-economic: Fisheries, Tourism, Industry

The workshop groups were requested to consider the information provided as a whole rather than comparing the work done by each company. The purpose and scope of the Technical Evaluation as provided to the participants is attached as Appendix C.

The workshop groups attempted to follow the six question format. However, in some cases, reorientation was required to deal with specific issues. This is reflected in the reports of the workshops. The socio-economic workshop report combines the deliberations of the two separate workshop groups. Workshop moderators were requested to include dissenting comments, if

any, in their reports. The results of the workshop deliberations were presented by the moderators at plenary sessions to allow for comment and questions from all participants.

Workshop debate provided the basis for an interdisciplinary exchange of thoughts. The workshop overviews presented in the next section summarize the opinions expressed by the participants at the Technical Evaluation and are presented here with minimal editorial changes.

The conclusions and recommendations of the workshop groups documented in this report, in conjunction with the IEEs, are intended to facilitate the public review and to assist the Panel with its deliberations on the terms and conditions under which exploration might proceed in a safe and environmentally responsible manner, should a decision be made to resume exploratory drilling activity.

2. WORKSHOP SUMMARIES

2.1 COASTAL GEOLOGY AND GEOMORPHOLOGY, SURFICIAL GEOLOGY, PETROLEUM GEOLOGY AND SEISMICITY WORKSHOP

Introduction

This workshop report provides a summary of comments arising from discussion on the following four topics: coastal geology, surficial geology, petroleum geology and seismicity.

The workshop directed its assessment of the two IEEs to each of the four topics by reference to questions pertaining to: the known effects; adequacy of description; adequacy of evaluation of impacts; identification of information gaps and how they could be dealt with; adequacy of scale and probability of assessment; and, description of preventive/operational practices. Following open discussion on each topic, the results were summarized by the rapporteur.

In general, the overall opinion of the workshop is that both documents provide sufficient description and analysis for assessment of the potential impacts of oil and gas exploration activity as they relate to the topic areas. It was acknowledged that deficiencies do exist in the IEEs, as is

noted below, but that all of the information could be acquired as a standard requirement for obtaining appropriate regulatory approval.

Results of Workshop Deliberations

Coastal Geology

Both IEEs contained good descriptions of this topic. It was felt that ongoing research programs by government and industry to address information that will be needed for contingency plan formulation would be able to supplement the existing information base to fulfill regulatory requirements for exploratory drilling.

Surficial Geology

The descriptions of the surficial geology of the area are adequate at this stage, although it was mentioned in a written submission that additional information was available to prepare a more comprehensive regional synthesis.

Due to the nature of seafloor hazards in the area, such as active faults or sediment instability, there would be a regulatory requirement for pre-drilling seabed surveys of both a regional and site specific nature.

Petroleum Geology

Chevron's treatment of this topic is considered adequate, but Petro-Canada's discussion on the geological evolution of the region was to some extent incorrect and incomplete. However, key aspects required for an adequate treatment were summarized in their presentation during the plenary session. A transcript of this more accurate presentation should be provided to the Panel.

Seismicity

The high level of seismicity in the area was discussed thoroughly in both IEEs. The issues mentioned above concerning the linkage between earthquakes and sediment movement or liquefaction and the need for regional and site specific seabed survey prior to drilling is applicable here also.

COASTAL GEOLOGY

Question 1: Known Effects

In routine operations, there would be minimal impact on coastal areas.

Question 2: Adequacy of Description

The consensus was that descriptions of coastal geomorphology, coastal processes, etc. were adequate. Although both IEEs identified ecological reserves properly, it was felt by one workshop participant that neither IEE provided an adequate evaluation of the coastal geology and processes characteristic to these particular areas; group consensus was that such detailed description was not necessary at this time since potential drilling locations within the region had not been determined.

Question 3: Adequacy of Evaluation of Impacts

The evaluation of the impacts of an oil spill on coastlines was treated adequately in both IEEs.

Question 4: How Information Gaps Can be Accommodated

The consensus is that the general description for the topic areas for the purposes of an IEE are adequate for regional analysis. However, in order to prepare a contingency plan, more site specific coastal geomorphological, sedimentology and coastal process information is thought to be necessary.

This data will need to be collected after specific drilling locations have been identified. The ongoing scientific programs by government will provide additional useful background information.

Question 5: Adequacy and Scale of Probability Assessment

The IEEs and plenary presentations by the companies indicate that coastline impacts from an oil spill would probably be less severe than from a tanker accident. The workshop was in general agreement with this observation. There is a good treatment of blow-out scenarios in both IEEs.

Question 6: Description of Preventive/Operational Practices

Regulations require that contingency plans outline how the companies would deal with oil spill clean-up. Sufficient data is not presently available in the IEEs to develop contingency plans for specific sites. However, consensus was that the companies would be required to remedy these data gaps prior to initiating drilling; that is, when specific drilling sites have been identified.

SURFICIAL GEOLOGY

Question 1: Known Effects

Exploration operations will have negligible effects on the surficial geology; however, certain characteristics of the surficial geology could create potential drilling hazards. Hazards in the region could be:

- slumping in proximity to shelf/slope break, and subsea channels;
- rapid erosion on the seafloor;
- sediment transport on the seafloor, existence of sand waves;
- shallow faults related to tectonic features and to slumpage;
- mass sediment movements;
- boulder fields; and,
- occurrence of shallow gas.

Petro-Canada's IEE contains an adequate inventory of these potential hazards. However, neither company discusses these hazards satisfactorily in the context of the West Coast marine environments.

Question 2: Adequacy of Description

The consensus was that the surficial geology descriptions in both IEEs was somewhat general in nature.

Although more detailed site descriptions are desirable, specific drilling locations are not known at present and hence the general treatment. However, the additional regional data now available, are considered to be satisfactory.

Workshop participants noted that regional surficial geology information was available from the Canadian Hydrographic Service and Geological Survey, so that more detailed surficial maps could have been prepared. One company stated that this regional data was not available at the time their IEE was being prepared. This information should be made available for the Panel review.

Question 3: Levels of Impact

Since the occurrence of surfical hazards in the region is still not well understood, assessment of levels of impact is difficult, especially for specific well sites.

Possible hazards could be the burial of the wellhead, collapse of the seafloor at the wellhead, and erosion near the wellhead. General treatment in the IEEs with regard to occurrence of hazards and levels of impact on drilling operations needs improvement.

Question 4: Information Gaps

The IEEs could be improved by using both currently available and up-to-date surficial data. Regulatory requirements specify that detailed site specific geotechnical surveys are required prior to drilling. A requirement for seabed surveys of a more regional nature would likely be necessary for this area, in additional to the site specific surveys noted above.

Question 5: Adequacy of Scale and Probability

The IEEs do not address the scale of these hazards. For example, areas affected by mass sediment movements. Additional work will be needed as knowledge of the region improves. Until regional data is available this assessment is not possible.

The linkage between these hazards and seismicity is direct and the opinion was expressed that even small

and intermediate magnitude earthquakes could trigger sediment movement and sediment liquefaction. Thus, probability of occurrence is related to earthquake magnitude and frequency. Also, phenomena such as landsliding and liquefaction can cause effects at considerable distances from their source due to turbidity currents and waves. The occurrence of these phenomena could certainly affect the safety of drilling operations.

Question 6: Preventive/Operational Practices

Both IEEs acknowledge that seabed surveys will be conducted prior to drilling and that changes to well locations could be required if hazardous conditions are identified.

PETROLEUM GEOLOGY

Question 1: Known Effects

The effects of drilling operations are treated adequately. Geological conditions that may lead to a well blow-out were also identified in a satisfactory manner. It was felt that the effect of gas hydrates

on the safety of the drilling operation was not adequately addressed.

The possibility of zones of lost circulation and their effects is mentioned only briefly and needs some further elaboration.

Question 2: Adequacy of Description

Gas Hydrates

The water depths in portions of Chevron's and Petro-Canada's areas of interest could be great enough to create hydrate conditions. A more detailed analysis is required on the theoretical pressure-temperature conditions with respect to the probability of occurrence and existence of gas hydrates.

The description of the possible impacts on a drilling operation from the release of gas from gas hydrate zones is not adequate. Also the effects on the sediment column and on casing integrity needs to be addressed in more detail.

The description of gas hydrate occurrence should include subsurface pressure-temperature conditions, water depth and water temperature conditions, and how gas hydrates can be detected in advance of drilling.

Petroleum Geology

Consensus was that Chevron's treatment of the subject was adequate, altnough discussion was limited because it dealt only with the previously published literature.

There are technical and interpretive problems identified in Petro-Canada's discussion of the tectonic framework, geologic evolution and hydrocarbon potential of the area. However, Petro-Canada's presentation to the seminar contained the key points, including good maps and illustrations documenting the petroleum geology of the area. Updates of the most recent interpretations from both companies should be made available to the Panel in order for them to address the issues related to this particular topic area.

Question 3: Adequacy of Evaluation of Impacts

Most operational hazards, with the exception of gas hydrates and the effects of lost circulation, are treated adequately in the IEEs.

Question 4: Information Gaps

Continuing research in the petroleum geology of the area within government institutions and the companies will reduce the inadequacies evidenced in the IEEs.

Question 5: Adequacy of Scale and Probability Assessment

The probability of an oil blow out occurrence was treated adequately in the IEEs, based on world-wide statistics. However, it was felt that statistics drawn from analogous areas, such as the California and Alaskan basins would have been be more relevant to the discussion.

The general consensus was that since the 14 wells drilled previously in the area did not present any problems, safe drilling operations could be anticipated.

The methods used to analyze the likelihood of blow out occurrences are adequately described.

Question 6: Description of Preventive/Operational Practices

Factors related to petroleum geology are adequately discussed in the IEEs.

SEISMICITY

Question 1: Known Effects

The effects of seismicity on the drilling operation are described adequately and the high occurrence of earthquakes in the region was noted. However, more emphasis on the linkage between small, medium and large magnitude earthquakes and consequential subsea sediment movement is necessary (see page 13).

Question 2: Adequacy of Description

In general, the description of the area's seismicity is adequate. However, the point raised in Petro-Canada's IEE concerning the behaviour of a strike-slip fault and its likelihood of sealing off a drill hole was questioned. Additional information on

this aspect will be required for a suitable assessment of the problem.

Question 3: Adequacy of Evaluation of Impacts

The linkage between earthquakes and sediment slumping, landslides and liquefaction required more emphasis in both IEEs.

Question 4: Information Gaps

The ongoing work of the Earth Physics Branch, EMR should assist in providing updated information on frequency, magnitude and epicentres of earthquakes. This information will be critical in selecting specific well locations.

Also, the Branch will be able to provide a location-specific assessment of earthquake parameters once a drilling location is chosen.

Question 5: Adequacy of Scale and Probability Assessment

Both IEEs treat this concern adequately.

Question 6: Description of Preventive/Operational Practices

Not applicable.

GENERAL COMMENT

Description of Marine Seismic Operation

The description of the field operation of a marine seismic survey was not described adequately in either IEE. The operation should be described so that the reader can comprehend the potential interactions that marine seismic may have with fishing activity and coastal shipping.

2.2 PHYSICAL OCEANOGRAPHY AND METEOROLOGY WCRKSHOP

Introduction

A technical group consisting of representatives from government and industry reviewed the physical oceanographic and meteorological sections of the IEEs. The review followed the six question format where possible; however, discussion of the IEEs within this working group focussed more appropriately on the impact of the environment on the design and operation of drilling units and their related activities.

The general consensus of the group was that the various sections of the IEEs ranged from adequate to commendable. Sparsity of data for site-specific evaluation was a common problem. Due to the timing of presently ongoing programs which could provide additional appropriate data, it was not possible to include them in the IEEs. However, the proponents were aware of such programs.

Detailed comments were provided by Ocean Sciences and Surveys (OSS) and the Atmospheric Environment Service (AES). The written texts, which were distributed to workshop participants, were found to be very useful in outlining, in detail, concerns and comments on the IEEs. Due to time constraints, only those comments directly related to the six

questions were discussed. It was agreed that other comments on the documents should be discussed later as required by the respective parties concerned.

Some of the data gaps identified related to operational requirements which would have to be fulfilled during the regulatory process for an exploration program. While these data gaps were noted, they were not discussed in detail.

Results of Workshop Deliberations

QUESTION 1: Known Effects

The generic effects of the proposed activity on physical environmental parameters, related to physical oceanography and meteorology, were considered to be very minimal and localized.

The main areas of concern were the effects of the physical environment such as winds, waves, currents, visibility, freezing spray etc. on the design and operation of a drilling unit and its related activities, such as contingency planning, countermeasures, and oil spill trajectory analyses.

Offshore drilling units are designed to withstand one hundred year storm criteria, which include 100 knot winds, 30 m waves and 2 1/2 knot currents. It was the general consensus of

the workshop group that the IEEs do not contain sufficient oceanographic data to provide reliable 100 year return values. However, OSS programs presently underway should provide the necessary data to fill this gap. The workshop group felt that sufficient information presently existed to provide a rough estimate of the 100 year wind event.

For other aspects, such as contingency planning and oil spill trajectory modelling, it was felt that data were sparse and that more information was required before an adequate assessment could be completed.

In the IEEs survival limits for a drilling unit were related to 50 year return values. The workshop agreed that the assessment should be extended to the 100 year storm values.

QUESTION 2: Adequacy of Description

The elements of the environment identified to be the most important for design purposes were winds, waves and currents. For the three areas (Dixon Entrance, Hecate Strait, and Queen Charlotte Sound), 100 year return values for winds were based on land and island stations. While this approach provides a rough estimate of the wind conditions, further studies will be required to obtain better estimates over the ocean.

Data for waves and currents for the three areas were judged to be very sparse. Considering some of the values observed in certain locations, conditions are worse than previously believed. For example current values of 75 cm/sec were found regularly at 50 m depth near Cape St. James, with a maximum value of 114 cm/sec. These values could indicate regular surface currents of 2 knots, which would require that the 100 year return value needs to be reassessed. In addition, it was felt that waves could approach 100 year values more frequently at certain sites.

In summary, the IEEs describe the three areas adequately based on the information available at the time they were completed. However, the sparsity of data does not allow an adequate description of winds, waves and currents for Queen Charlotte Sound, Hecate Strait and Dixon Entrance. Present ongoing programs should fill some of these gaps.

QUESTION 3: Adequacy of Evaluation of Impacts

Levels of impact by the environment on rig design are based on 100 year storm conditions (winds, waves and currents), and those for the operation of the rig and its associated activities are based on the operating criteria of each activity. Drilling units are designed to meet the standards established by certification societies and to meet the

regulations of the Canadian Coast Guard and COGLA. On this basis it was judged that for design purposes, the levels of impact were adequately identified taking into consideration the limitations described above (See Question 2).

During the discussion, two questions were raised which should be addressed in the near term:

1. An assessment should be made to determine the effects of having any one or any two of the three parameters reaching the 100 year return values on a drilling unit itself and on its operations.

2. An assessment should be made to determine the probabilities of simultaneous occurrence of the 100 year values for the three parameters concerned.

QUESTION 4: How Information Gaps Can be Accommodated

Physical oceanographic and meteorological information for the three areas was recognized to be generally sparse. For example, wind data measurements from ships of opportunity and from land stations which suffer from fair weather bias and incomplete spatial coverage, are not quite representative of over-water conditions.

While physical oceanographic data for the three areas are sparse, some programs presently underway will help to remedy this situation. Some specific concerns relate to the Cape St. James area, which is known for its very rough conditions, and to the currents around Langara Island. It is not known whether these currents continue into Dixon Entrance or back out around Learmonth Bank.

For special applications such as oil spill trajectory analyses, more studies will be required during the regulatory phase to assess surface and subsurface currents. Some wave measurement programs have been undertaken by Seakem.

The following data gaps were noted:

1. Dixon Entrance - some current meter measurements are being taken in the vicinity of Dixon Entrance. Measurements need to be taken in the central Dixon Entrance area to determine oceanographic characteristics. Also, surface drifter data will be required for oil spill trajectory modelling.

   Further analysis of available wind information around Dixon Entrance should be made.

2. Hecate Strait - while the existing data for physical oceanography is sparse, presently planned programs should provide better information for estimating 100 year return values and the general characteristics of the wave and current conditions. More direct wind measurements should be made.

3. Queen Charlotte Sound - while there have been two winter wave measurement programs none are presently planned for currents during winter. This is an important gap because winter conditions tend to be more severe.

   A submerged listening device has been installed to provide wind magnitude data near Cape St. James. Additional programs to measure wind directly may be needed.

In general the need to fill in the information gaps for the three areas can been approached in two phases. Priorities for data analysis should be set according to the following needs:

1. Information required for improving the estimate of 100 year return values for design purposes. This type of analysis will be required prior to determining whether

a proposed exploratory drilling project could be approved-in-principle.

2. Information is required for improving our knowledge of the physical environment to develop effective counter measures, contingency plans, spill trajectory analyses etc. Such assessments will need to be made prior to applying for approval to proceed with exploration during the regulatory process.

Other needs identified, not specific to any one of the three areas were:

1. On an operational basis, when an activity is underway, a priority should be placed on establishing a real - time weather forecasting network which would include feeding real-time data into the AES network.

2. For long-range planning purposes, other methods such as a scatterometer to measure winds should be considered.

3. From a research point of view, effective surface drifter and vector diseraging techniques to measure surface currents need to be developed.

QUESTION 5: Adequacy and Scale of Probability Assessment

Some members of the workshop felt that the term "probability" referred to quantitative values, whereas the majority considered it in its qualitative sense. In this respect there was some dissent. However, the consensus was that the probability of accidents associated with seismic surveys and exploratory drilling was quite low, and that the issues were adequately assessed in the IEEs.

There were five issues identified and discussed as follows:

1. Blow outs - There has never been an oil blow out during offshore exploratory drilling, according to statements made by both Chevron and Petro-Canada representatives. The probability of any kind of blow out occurring was given as 0.03%, or one in every 3000 wells drilled.

2. Collisions - The risks of collision were considered minimal with the exception of certain pilotage stations. All large deep sea vessels should carry pilots within pilotage waters to minimize the risk for those areas. During seismic surveys, intercept vessels should be used to steer other boats clear of the 2 mile long geophone detector cable being towed

behind the seismic survey boat. Where possible, exploratory drilling should be conducted outside main shipping lanes.

3. Seismicity - The probability of an accident occurring due to seismic activity was considered to be low. The technology and expertise exists for drilling across faults and in seismically active areas. However, the effects of earthquakes on offshore exploration operations will require further evaluation (see page 18).

4. Slick Trajectories - There is not at present enough data on currents, winds and waves to accurately predict slick trajectories. However, an initial study of slick trajectory rising surface drifters will be concluded in Dixon Entrance by OSS/IOS in June 84. Techniques for measuring surface currents need to be developed. Measurements of deep currents are also needed to predict the movement of subsurface oil. Slick trajectory analyses will be addressed as part of the regulatory process.

5. Spill Volumes - The maximum flow rate for a blow out was given as 5000 bbl/day for 90 days, the maximum

estimated time required to bring the well under control.

While the above noted assessments provide an adequate evaluation of the accidental occurrences noted, in general, further evaluation will be required for site-specific areas when they are identified.

There was one dissenting opinion: an assessment of the scale and probability of accidental occurrences should be based on a quantitative analysis of worldwide statistics for the issues mentioned above.

QUESTION 6: Descriptions of Preventive/Operational Practices

It was generally agreed that the descriptions of the approaches used in both IEEs to develop contingency plans and other measures to mitigate or offset the effects of accidental or routine occurrences were well addressed. However, the information base for such plans is sparse.

It was pointed out that areas within the zone of influence of seismic and exploratory activities may have to be priorized in order of their biological significance. Both IEEs have addressed the fact that most accidents are caused by human error. Training programs to minimize human error will

therefore be required. The use of real-time weather services is also needed to abate the risks of accidents.

More information is required to develop guidelines for weather-sensitive operations such as fuel loading. It was pointed out that manuals for such operations exist, and will be used; however, more information specific to the north coast of British Columbia may be required.

Guidelines for the use of chemical dispersants are in place (e.g. wind, wave, and temperature limits).

In general, it was the consensus of the working group that the approach to contingency planning was adequate, and that improved oceanographic and meteorological knowledge will reduce risks. Specific plans and measures, when developed, will be subject to review.

A minority opinion was expressed that contingency plans, as outlined in the IEEs, are not adequate because they have not provided exact procedures and details for contingency planning.

2.3 PLANKTON, FISH AND BENTHOS WORKSHOP

Introduction

The following comments and concerns identified by the interagency members of this workshop are not necessarily comprehensive nor complete.

In addition to the workshop review, written comments by the institute of Ocean Sciences, Department of Fisheries and Oceans pertaining to ocean ecology were provided to representatives of COGLA and the British Columbia Ministry of Energy, Mines and Petroleum Resources.

Results of Workshop Deliberations

Question 1: Known Effects

Most of the general impacts or effects of exploratory activities, including seismic work, have been addressed in the IEEs. However, several significant information gaps and criticisms regarding the conclusions and interpretations relating to impact assessment were identified and are as follows:

1. Statements in the IEEs suggesting that there has been no evidence in the world literature of adverse effects of large oil spills on fish populations or stocks are somewhat misleading. Specifically, to our knowledge there has never been a massive oil spill in locations utilized by large concentrations of juvenile or adult salmon which are characteristic to the west coast. Indeed, basic information on impacts of oil on salmon species, particularly with respect to their marine life history stages and implications on population or stocks, is not available in the literature. Therefore, there is little basis on which to confidently apply, by inference, this type of "no documented impact" observation to coastal areas of British Columbia for salmonids.

2. It is understood that without more complete information on the generic effects of oil on specific organisms, statements regarding impact assessment must of necessity be determined by "best guesses" and by inference from the literature pertaining to similar species in other locations.

3. The information relating to the impact of drilling muds is generally adequate and presents a good documentation of the data base. However, more

information and discussion on the long term trophic (food chain) effects and the possible impacts on salmon species would be a valuable addition to the information provided.

4. With specific reference to marine ecological reserves, there would be value in documenting the impact of oil spills on the benthic communities and "value" or "future usefulness" of these specific areas if oiled.

5. It is stated in the document that only air guns will be used for seismic exploratory work. Should a need for chemical explosives be identified, further discussion of effects would be needed.

6. With respect to the discussion of petroleum impact on marine plants, more complete referencing of statements in the IEEs would be helpful in assessing the conclusions reached.

Question 2: Adequacy of Description

Some specific data gaps identified by the workshop members were:

1. There are known deficiencies in the available data regarding marine migratory patterns of salmon on the West Coast, particularly in the early life stages (juveniles), which is reflected in the IEEs. However, meaningful estimates of nearshore utilization and seaward migrations of juvenile salmon could be made by using existing stream/river escapement data. This information could then be used to compare the utilization by juvenile salmon between areas of the north coast.

   It should also be noted that impacts from offshore exploratory activity in the north coast area may affect salmon stocks which originate in southern areas of the B.C. coast and which are a significant component in the commercial, native, and recreational fisheries of those areas.

2. Contrary to statements in the documents, the plankton communities are not distributed homogeneously in northern waters. Although significant deficiencies in the available literature on the subject are recognized, these communities are known to exhibit differences in density. Correcting such data deficiencies could assist in generating and interpreting predictions of impacts from oil spills.

3. The available literature on microbial ecology appears to have been adequately reviewed. However, statements regarding the effects of nutrient availability and the ability of bacteria to break down oil are incomplete and need further evaluation. Specifically, seawater may not contain sufficient amounts of nutrients to support significant degradation of oil. Therefore, naturally occurring oleoclastic bacteria may not provide a significant contribution to the breakdown and dispersion of spilled oil and should not be considered as important a component in any mitigating strategy as suggested in the IEEs.

4. There are deficiencies in the available literature regarding general fisheries resource data bases. This is recognized by the resource agencies and is reflected in the documents.

Examples of these data deficiencies are:

- groundfish rearing/spawning areas
- ichthyoplankton distribution
- seaward/marine salmon migratory routes

Therefore, because of these information gaps in the literature, the applicability and accuracy of the impact assessments in the IEEs were seriously questioned by the workshop members and should only be interpreted with a certain degree of caution and qualification.

5. Regarding the issue of effects of the environment on impact assessment, it is important to recognize the need to integrate the assessment of physical oceanographic processes with the biological component to adequately review and predict possible impacts. For example, in order to assess potential impacts on groundfish, predictions concerning sub-surface current patterns relating to the transport of sinking oil should be considered.

6. The inter-relationship of impacts on various levels of the food web on higher level consumers (i.e. salmon) is unclear in the documents. This has short and long-term implications and is important in the assumptions relating to impact predictions. Therefore, a discussion of these relationships would be useful.

Question 3: Adequacy of Evaluation of Impacts

The comments below reflect an attempt to integrate question 1 (impact information) with question 2 (inventory information) to evaluate whether the level of potential impact described in the IEE's is adequate.

Discussion in this workshop pertained primarily to impact and mortality predictions. Specific comments and issues raised in the workshop were as follows:

1. Variability and differences in life cycle and seasonal sensitivities of, for example, ichthyoplankton and salmon, as well as physical/chemical oceanographic considerations, have not been adequately addressed in the oil spill scenarios. This has led to impact predictions which may be too conservative.

2. It is recognized, given the available data, that the impact predictions are "best guesses" based on interpretations and assumptions. Therefore, caution should be exercised in the interpretation and assessment of these predictions in recognition of data deficiencies and interpretative statements of resource information. Similar caution should also be applied to assessments of economic values generated from these spill scenarios/impact predicton exercises. This exemplifies the essential need to integrate the biological and socio-economic reviews.

   Re-evaluation of the potential impacts of oil on juvenile salmonids may be required in light of salmon escapement data extrapolations with respect to seaward

migrations identified in Question 2. Any changes would of course have to be reflected in contingency plans.

3. In general, it was agreed that due to deficiencies in existing knowledge of all biological factors which need to be integrated into an impact assessment (for example, basic life history information, food web relationships, avoidance behaviour, direct lethal toxicity levels, and sublethal effects) predictive capability and accuracy of such assessments can be expected to be extremely variable, of questionable validity and subject to serious criticism.

Question 4: How Information Gaps Can be Accommodated

1. As mentioned previously, several deficiencies in the available information/literature were identified in the workshop and included:

   (i) seaward migration patterns of juvenile salmon
   (ii) ichthyoplankton distribution
   (iii) long-term sublethal impacts of drilling muds on trophic levels (food chain) and general impacts on salmon
   (iv) groundfish rearing/spawning areas

(v) impacts on fish stocks and populations

(vi) effects of impact at various trophic levels on fish populations.

This information is important in the assessment of mitigative considerations and capabilities.

2. The need to assess the benthic communities of marine ecological reserves before initiating offshore activity was identified. This may be important for future compensatory/restoration considerations.

3. Operational requirements and considerations relating to exploratory drilling were identified:

(i) The proximity of drilling activity to near-shore areas is an important issue and has significant implications relating to environmental impacts from drilling muds, small-scale contaminant discharges/releases, and from catastrophic oil spill events.

(ii) It would be valuable to identify those concerns and associated regulatory controls (caveats), as well as the continuum of contingency planning for coastal zones, that are dependent upon or

associated with near-shore activity. This is particularly important in providing adequate information in a public forum.

4. There is a need to identify data deficiencies and to priorize these deficiencies in terms of their relevance and importance to the decision-making process. There is also a need to integrate the biological information with socio-economic data.

Question 5: Adequacy of Scale of Probability Assessment

It was considered that this issue was not applicable to the specific subject area nor was the expertise present in the workshop to exact an evaluation.

Question 6: Description of Preventive/Operational Practices

For clarity, this question was divided into two categories of oil related effects:

1. Routine operations

Specifics identified in discussion included drilling muds and small-scale oil contaminant spills. Both

aspects appeared adequately well documented and were considered generally mitigable.

2. Catastrophic oil spills (blow outs)

Countermeasure considerations appeared to be adequately identified. There is a need to integrate physical oceanographic and meteorological information in predicting the mitigative capability of industry for large oil spills. For example, given the known weather regime of Chatham Sound, what percentage of the time will oil spill countermeasures and equipment be successful in preventing oil contamination of the Skeena estuary?

The capability to control, contain and remove oil spilled at sea was seriously questioned by workshop participants. In consideration of the remoteness and high energy of many coastal near-shore environments, the effectiveness of containment and cleanup options would require further investigation.

2.4 BIRDS AND MAMMALS WORKSHOP

INTRODUCTION

The workshop participants evaluated the IEEs to determine the technical adequacy of major issues with respect to the impact of the proposed exploration activities. In general, this followed the six question format suggested for the Technical Evaluation, but concentrated on areas of data gaps and how these might be resolved.

Results of Workshop Deliberations

QUESTION 1: Known Effects

The workshop participants examined the IEEs to determine if all significant generic effects of exploration activities on birds and mammals had been identified, and their nature characterized in an adequate level of detail, to allow proper interpretation of the significance of impact. It was concluded that the documents were of good quality and demonstrated most of the possible interactions of exploration activities on biota; but, there were a number of problem areas or issues on which the information presented in the IEEs could be improved. These include:

1. A description of the effects of "air gun" seismic (i.e. non-chemical explosive methods) on birds and mammals.
2. The possible indirect effects of drilling waste discharges on marine birds and mammals.
3. The effects of oil on marine mammals, especially with regard to behavior, interference with baleen function, hydrocarbon metabolism and skin lesions.
4. The rationale for the indices used to categorize significance of impact; ie., an explanation of the apparently subjective index of areal influence used by Petro-Canada or that of proportional adult mortality used by Chevron.
5. The indirect effects of oil spills and of other potential impacts of exploration activities, as mediated through the bird and mammal food chain. The food chains presented in the IEEs are simplified and condensed to aid understanding. However, they do not identify key organisms required for the reproductive success and survival of several of the marine birds. The significance of the impact on the food chain could be very high for both migrant and territorial species and should be covered by discussions in the benthic study section. A cross reference between sections would have been useful.
6. A discussion of potential additive or synergistic effects of disturbance factors originating from the various exploration activities.

7. Neither document assessed the impact of any activity on Ecological Reserves (ER). Exploration accidents, countermeasures and mitigation could impair the ability of an ER to function as a representative benchmark of the ecosystem which it was set up to preserve. This is particularly the case for those ERs established where birds and mammals are the key biota.
8. Inadequate use of existing significant literature on B.C. seabirds.
9. Evaluation of the effects of rig lighting and gas flaring on birds, especially in areas of high bird density or in migration areas.
10. An assessment of the significance of long term habitat changes, especially in low energy environments such as the shorelines of estuaries.

QUESTION 2: Adequacy of Description

The participants identified a number of errors or inadequacies which would either influence some regional estimations of significance of impact, or else demonstrated an inadequate data base for effective contingency planning. In particular, these included:

1. An error in sea otter distribution in that the Bunsby Island population was not identified (other than this, the

description of marine mammal distributions were considered good).

2. The IEEs did not adequately describe the impact on populations in so far as the documents did not recognize the presence or status of some species, the division of some populations into discrete age and sex classes, or the potential sensitivity of some populations to perturbances of their prey items. This was partially due to a selective use of the large quantity of literature available at the time of the preparation of the IEEs, which preceded several major research projects. This could be highly significant for the black oystercatcher, harlequin duck, barrow's goldeneye, white-winged and surf scoters, brant and many of the colonial alcids. The description of the susceptibility of some species to oil was limited by the use of outdated information.
3. There was no biological consideration in the analysis of shore-zone significance for northern Vancouver Island and for the waters of the inlets along the mainland northshore coast. These are important areas for many species of wintering birds. There was concern that oil spills reaching these areas may not be flushed out due to the peculiar physiography of the area, thus extending the oil contamination issue into a long-term problem.

QUESTION 3: Adequacy of Evaluation of Impacts

It was the opinion of the participants that with regard to the generic effects described in Question 1, points 9 and 10 have the potential of influencing the results of the calculation of significance of impact. Points 1 to 8 would not change the assessment of significance of impact, but the workshop participants felt that the topics were issues which would be of interest in the public review.

QUESTION 4: How Information Gaps Can be Accommodated

The working group considered their deliberations on Question 4 to represent its most significant contribution to the Technical Evaluation. Three categories of information on data gaps were formulated:

A. Where a better description of an issue would have been desirable in the IEEs through an expanded statement, permitting better evaluation of the proposals in the public review.

B. Where new or additional literature on data of significance existed, which should have been used to address issues of concern. Contact people were identified who could act as guides for the companies to the information. If such information were not considered, this would have effects on:

1. the credibility of the proposal for renewed petroleum exploration, and
2. the assessment of the significance of impact.

C. Studies which may be necessary to allow effective management of exploration through the regulatory process. This referred particularly to drilling activities, where effective contingency plans would be a requirement.

Detailed recommendations were as follows:

Category A - expanded statements on:

- effects of seismic noise, i.e. to explain why air guns are considered innocuous with regard to acoustic impact.
- discussion of indirect effects of drilling discharges on marine birds and mammals, mediated through the food chain, especially with regard to effects on obligate food species.
- an additional statement of the significance of loss of biota (especially birds) and on the status of ecological reserves.
- additive effects and synergistic effects should have been mentioned in the IEEs, but none of the reviewers felt that the present state of knowledge was sophisticated enough to determine the significance of the impacts.

Category B - Treatment of additional/new information or data on:

- response of marine mammals to oil with respect to behavior, coating effects and metabolism (contact, R. Engelhardt).
- influence of rig lighting and flaring in areas of bird concentration or migration paths (contact, G. Kaiser)
- additional/new information of sea otter distribution - relates to regional assessment of significance of impact (contact, M. Bigg).
- birds - some significant literature was not cited/used, although this was available, especially with regard to the alcids. This relates both to descriptions of regional distribution and the natural history of the seabirds (contact, G. Kaiser and K. Vermeer).

Category C - Studies deemed necessary before drilling commences (the question of responsibility for who carries out such studies was not addressed by the working group):

- A major issue is an expansion of the information base on obligate food dependencies in some bird species, necessary prior to issuance of drilling program approval. Such information may be needed to define windows suitable for exploratory activities. This is not necessarily a deficiency in the IEEs, but is necessary in the preparation of contingency plans and

site specific evaluations, and should precede the approval of drilling programs by forming part of the contingency plan in support of a drilling program proposal.

- Additional and detailed information on regional species distribution would have to be assembled from
  a) new data now available, and
  b) future field studies

  to allow safe and effective drilling programs. There appears to be a lack of data for a definitive determination of resources at risk.

QUESTION 5: Adequacy of Scale of Probability Assessment

The subject of this question was felt to be not in the area of expertise of the working group. A general comment was that assessment of the scale and probability of an accidental discharge of oil was not easily made at this time because of inadequate current and weather data.

QUESTION 6: Description of Preventive/Operational Practices

A number of general comments were made on Question 6:

1. The description of the regulatory process with regard to mitigation and abatement measures was good.

2. Countermeasures available to the exploratory drilling operations were adequately characterized. The participants were uncertain about the chances of any of them being effective under the sea and weather conditions of the study area. Some countermeasures could have a serious long term impact on sensitive environments such as estuaries. Those were not adequately addressed in the IEEs and yet their impact could be significant or in conflict with the goals of other management agencies (i.e. Fisheries).
3. The participants doubted the efficiency of some of the proposed countermeasures such as the use of coloured dyes in oil spills. Their reliability or applicability in an emergency has not been well tested.
4. There was not enough description of dispersants as a countermeasure to provide information for evaluation. However, the use of dispersants should be addressed in the contingency plan. The problem of conflicting resource management policies must be resolved between ministries (i.e. bird vs fish).
5. It would have been useful to have described the contingency planning process in greater detail, identifying for the readers of the IEEs that the process was a dynamic one. Contingency planning should be able to incorporate into its environmental protection function the output of the environmental review process, integrating new information or data, as well as recommendations on how the proposed petroleum exploration activities may proceed safely.

2.5 SOCIO-ECONOMIC AND SOCIO-COMMUNITY WORKSHOPS

Introduction

Both IEEs are evidence of the time and effort Petro-Canada and Chevron have committed to outlining the potential environmental costs and benefits of offshore exploration. However, for conducting public hearings, further information may be required by the panel to substantiate some of the conclusions drawn in the reports.

The socio-economic workshop evaluation did not reveal any substantial disagreement with the IEEs conclusion that the economic and social impacts of routine exploration activities are likely to be minimal. However, issues of mitigation and compensation that could arise in the event of a major accidental occurrence could be difficult to address adequately in a public forum with the data base contained in the two IEEs.

The purpose of this section is, therefore, to alert the Panel to some important components of the economic and social environment in the northwest coast region which will likely require additional documentation if issues of accident mitigation and compensation are to be adequately discussed. In the following pages, the information gaps concerning economic elements relate directly to issues of mitigation and compensation.

RESULTS OF WORKSHOP DELIBERATIONS

ECONOMIC COMPONENTS

A more thorough description of the current and potential resource base for important sectors of the regional economy would be of value. Such a description would include more thorough information pertaining to:

(i) location and magnitude of the resource base; and,

(ii) current and potential utilization.

FISHERIES

Any discussion of the data base for fisheries analysis should recognize the sensitivity of catch allocations and other important parameters to federal government fisheries policy and to changes in the natural and economic environments. Moreover, it should be noted that results of the Plankton, Fish and Benthos Workshop indicate that the potential impact of offshore exploration on the fish resources of the study area may be underestimated. This would have direct consequences for the socio-economic analysis. These sensitivities mean that integrated analysis should be very carefully undertaken. Any socio-economic analysis is dependent on biological assumptions and therefore are only as accurate as these assumptions. The

observations that follow are intended to assist the Panel in obtaining as reliable an analysis as possible over and above what is already thoughtfully presented in the IEEs.

Commercial Fisheries

The analysis of this sector has been conducted appropriately in the IEEs. However, underlying problems with the base data are noted as follows:

1. Because of distortions within the industry, heavy reliance on the 1979/80 fisheries data misrepresents the analysis of annual catch, landed value, and value-added activity. Therefore:

   - for the salmon fishery, statistics should be averaged over 4 years;
   - for the herring roe, halibut, groundfish and abalone fisheries, and fish processing industry statistics, it would be most appropriate to take the most recent year for which statistics are available and compare to the previous 5 year average.

2. The distribution of economic value derived from the commercial fisheries may be over-estimated for the study area and under-estimated for the province.

Native Fishery

Further information concerning the native fishery would be a useful addition to the data base. This may include:

(i) Location and Magnitude of Resource Base: fishing grounds, harvesting areas, inventory of allowable catch, harvesting techniques, value-added activities, and mariculture activities.

(ii) Current and Potential Utilization: individual-based, community-based, market vs non-market utilization, value-added activities, income, employment, proportion of provincial industry, subsistence value, and economic significance to community.

Some of the above data is currently available from the federal Department of Fisheries and Oceans, and Dept. of Indian Affairs and Northern Development. More detailed information would only be available with the cooperation of the Indian bands. A description of the native fishery should take intc account new policy directions being contemplated for the B.C. fishery generally, and new directions for economic development emerging from within the Indian community.

Sports Fishery

To adequately assess this fishery resource base the sports fishery should be examined in relation to:

(i) Location and Magnitude of Resource Base: fishing areas, support facilities and services, outfitting camps, finfish/shellfish resources sought.

(ii) Current and Potential Utilization: cottage industry, full-service developments, resorts, seasonality, revenue/expenditures, proportion of provincial sport fishery, economic value to local community, and non-economic values (aesthetic, historical, cultural, etc).

Mariculture

Further information concerning the mariculture industry would also be useful, particularly:

(i) Location and Magnitude of Resource Base: beaches, estuaries, lease holdings, species harvested.

(ii) Current and Potential Utilization: individual/ community/company production; market vs non-market value, and employment levels.

TOURISM INDUSTRY

The Prince Rupert area is a destination for B.C. tourism. There are many tourism resources that could be in direct competition with the offshore industry or which could be affected by a major oil spill. Therefore, a more thorough evaluation of this resource would use useful, particulary:

(i) Location and Magnitude of Resource Base: physical sites (beaches, parks, wilderness areas, heritage sites, destination and service centres, cruise ship and tour routes).

(ii) Current and Potential Utilization: cottage industry, full-service developments, resort-based or city services, seasonality; incomes, jobs, importance to regional and provincial tourism industry, economic value to local community, importance to regional economy, non-economic values (aesthetic, historical, cultural).

Most of this information is readily available from the provincial Ministry of Tourism.

RECREATION

The study area has the potential for significant growth in the recreation area because of its unique physical aspects and proximity to transportation facilities in Prince Rupert. Further analysis of this resource would include:

(i) Location and Magnitude of Resource Base: shoreline sites and activities undertaken.

(ii) Current and Potential Utilization: individual/community activities, economic value, aesthetic values.

OTHER ECONOMIC ELEMENTS

The demand of offshore exploration activities for local industrial services and the potential regional supply requires more detailed documentation in order to identify possible industrial benefits. Reference can be made to federal industrial employment and socio-economic benefits policies and provincial procurement policies. It would also be useful in documenting local resources in the event of an accidental occurrence.

SOCIAL COMPONENTS

Both IEEs use some of the effects of offshore exploration on the east coast of Canada as an analogy for predicting economic and social impacts on the northwest coast of British Columbia. While useful, this analogy should be accepted with caution because of the contrasts between the two areas in economic base, the ethnic, education and work skills composition of the populations, as well as the longer term and larger level of east coast activity.

Each IEE uses a different figure to estimate the number of local jobs to be created by offshore exploration. It would be useful for the Panel to get a more detailed picture of offshore labour demand (that is, the types of jobs and requisite education and experience) and local labour supply (the education and experience characteristics of the local labour force). Having this information on hand will help the Panel address public expectations regarding these potential benefits of offshore exploration.

Similarly, the Panel may require some further information to address the potential economic and social costs of petroleum exploration, especially in the event of a major oil

spill. Both IEEs appear to address adequately the likelihood and potential "worst case" spill scenario and outline how each company would respond.

In preparing for public hearings, however, the Panel may find it useful to make a conceptual distinction between technical risk and social or perceived risk. Technical risk is usually expressed (as in the IEEs) in terms of the probability of an occurrence and is based on empirical observations of many similar events. Social or perceived risk, however, is an expression of feelings about the possibility of a single event and is guided by subjective impressions about particular technologies. Public opposition to the introduction of new technology or industrial activity is often most marked in cases where there is a wide disparity between technical perception of risk and social perception of risk.

Discussion in the socio-economic workshop indicated the likely existence of such a disparity in the communities of the northwest coast. To satisfactorily answer public questions in this context, the Panel may wish to have further information regarding:

1. How local communities can have formal input to the setting of priorities for protection in order to mitigate spill effects (i.e. assigning values to fishing areas, recreational and cultural sites, etc.).

2. How compensation for unmitigated impacts will be addressed, particularly in the case of resources to which a market price cannot be easily assigned (i.e. ecological reserves, recreational resources, loss of access, native food fish losses, losses at processors level etc.).

3. How responsibility for spill response and clean-up is to be apportioned between industry and governments and details of how the company contingency plans are develped once specific drilling sites have been identified.

Section 3

3. Conclusions and Recommendations

This section was developed independently of the participants of the workshop and serves to summarize the workshop recommendations from the COGLA and BCEMPR perspective.

Conclusions

The Technical Evaluation provided the basis for a very valuable interdisciplinary exchange of thoughts from which workshop consensus could be reached concerning the two IEEs. In general, it was felt that the IEEs provided by Chevron and Petro-Canada contained sufficient documentation to serve as the data base for a public review.

A number of issues were raised concerning areas in which the data could be updated, due to recent studies postdating the preparation of the IEEs. The workshops also identified areas where the Panel may require additional information before the public hearings or where governments would require additional information prior to giving regulatory approval. In addition, some long term studies were identified which could take place prior to or during the exploration phase specifically or during the development phase should a commerical discovery be made.

For convenience, these suggested additions have been divided into categories. However, readers are cautioned to consider the complete workshop reports in order to put the recommendations into perspective. No attempt has been made to set the workshop recommendations in order of priority for the Panel.

It should be noted that the companies are not responsible for acquiring all of the required information as some of the information falls specifically within the mandates of the provincial and federal governments.

Recommendations

Updating

From the time the IEEs were prepared and the Technical Evaluation, improvements to the biophysical and socio-economic data base for the region have occurred. This new information will assist in reducing recognized data gaps and weaknesses for specific subject areas. More specifically, information not found or adequately addressed in the IEEs concerning the following items is now available or will be available at a later date:

1. A regional synthesis of the surficial geology of the area.
2. Oceanographic data to provide reliable 100 year return values.
3. Additional information on B.C. sea birds, particularly alcids.
4. Response of marine mammals to oil in the seas - behaviour, coating effects and metabolism.
5. Influence of rig lighting and flaring in areas of bird concentrations or migratory paths.
6. Sea otter distribution.
7. Reworking of commercial fisheries analysis based on revised data base.
8. B.C. Native Fishery data.
9. B.C. Tourism and Recreation information.

Providing the above updated information as a supplement to the IEEs will improve not only the information base, but will facilitate a more thorough appraisal of potential environmental and social effects of the project by the Panel.

Possible Additional Information Requirements Needed for Public Hearings

The workshops identified specific information requirements which may be required specifically for the Panel review. They are:

1. A more thorough description of the possible location of areas having gas hydrates and effects of gas hydrates on the safety of the drilling operations.
2. Updates to the petroleum geology discussions in the IEEs, such as provided in the companies presentations to the seminar.
3. Assessment of the effects on a drilling unit or its operation of having any one or two of wind, waves or currents reaching the one hundred year values.
4. Assessment of the probability of simultaneous occurrence of 100 year return values.
5. An expanded description of the long term food chain effects of drilling discharges, particularly on obligate prey species.
6. Re-assessment of nearshore utilization and seaward migration of juvenile salmon stocks utilizing existing and updated stream/river escapement data.
7. A more thorough discussion of nutrient availability and the ability of bacteria to breakdown oil and sea water.
8. A description of governmental regulatory processes and requirements.
9. A more thorough description of the operation and possible effects of marine seismic operations.
10. A more thorough discussion of anticipated long term problems associated with oil in low energy environments.

11. More knowledge of the native fishery to assist in assessing possible impacts on that fishery. This information is currently not available and can only be provided by Indian bands.
12. A more detailed consideration of the current and potential economic value of the sports fishery and mariculture industries.
13. A description of offshore exploration labour demands including job types, education and experience requirements.
14. A description of emergency response mechanisms.
15. A compensation mechanism for unmitigated impacts in the event of an oil spill.

Information Requirements During the Regulatory Process in Addition to Existing Requirements

1. Improved coastal geology mapping for oil spill impact assessment in preparation of contingency plans.
2. Regional and site specific seabed surveys will be required when well locations have been identified.
3. The effects of earthquakes on offshore exploration operations need to be more fully evaluated.
4. A more thorough assessment of nearshore and intertidal benthic communities for oil spill contingency planning.
5. More detailed descriptions of regional species distributions.

6. Expansion of the information base on obiligate food dependencies in some bird species for contingency plans.
7. Assessment of plankton distribution and groundfish rearing/spawning areas requires a more thorough documentation.
8. Detailed geotechnical investigations of the seafloor.
9. Further evaluation of coastal geology and geomorphology in the vicinity of any extended drilling operations.

APPENDIX A

FEDERAL-PROVINCIAL AGREEMENT

Energy, Mines and Resources Canada | Energie, Mines et Ressources Canada

COMMUNIQUE

83/97
September 8, 1983

AGREEMENT REACHED ON ENVIRONMENTAL REVIEW OFFSHORE BRITISH COLUMBIA

OTTAWA – The Honourable Jean Chrétien, Minister of Energy, Mines and Resources, and the Honourable Stephen Rogers, Minister of Energy, Mines and Petroleum Resources for British Columbia, today announced a joint environmental review to assess the effects of offshore oil and gas exploration on the West Coast, north of Vancouver Island.

In a joint announcement, made simultaneously in Ottawa and Victoria, the Ministers said that the public environmental review will include consideration of the related social and economic effects of offshore exploration. The review is necessary before any consideration can be given to lifting the federal and provincial moratoriums on exploration in the area, they added.

"We have always given environmental protection a high priority," Mr. Chrétien said. "It is encouraging to see the governments agreeing to work together to safeguard the environment."

"A moratorium on offshore exploration in the Straits of Georgia and Juan de Fuca remains in place," Mr. Rogers noted. "This review will involve only those coastal waters lying between the northern tip of Vancouver Island and the international boundary just south of the Alaska panhandle."

The independent review panel will be made up of five members acceptable to both governments, with each side naming two and agreeing on the choice of a chairperson. The panel will be appointed this November, and is expected to report in the latter part of 1984.

The report will include recommendations on the terms and conditions under which exploration might proceed safely, should a decision be made to permit exploration.

If exploration is to be allowed, the Ministers agreed that a further public review would be needed before any operator could carry a discovery to the development or production stage.

Canada

- more -

The non-judicial environmental review, set in motion by the joint agreement, is without prejudice to offshore resource ownership claims.

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For further information, please contact: Debbie Schertler
Special Assistant to Mr. Chrétien
Energy, Mines and Resources Canada
(613) 593-5252

or

Jake Banky
Director of Communications
Energy, Mines and Petroleum Resources
for B.C.
(604) 387-5178

Attachments: Backgrounder
Agreement

BACKGROUNDER
JOINT WEST COAST ENVIRONMENTAL REVIEW

Resources

From 1967 to 1969, Shell Canada Resources Limited drilled eight wells in the agreement area but no significant discoveries were made. The last seismic programs were carried out in 1972 by Chevron Standard Limited. Recent geological interpretation suggests that the potential may be significant, particularly for gas.

Moratoriums

A federal moratorium on exploration drilling was imposed in 1971 and Orders-in-Council were issued to suspend work obligations for companies then holding exploration rights in the area. The moratorium was ordered in response to the environmental concerns of area residents and the provincial and federal governments, which related to proposed tanker traffic carrying Prudhoe Bay oil south to the United States.

Provincial oil and gas exploration permits in the Straits of Georgia and Juan de Fuca were suspended in 1970. In 1981, the provincial government ordered a general prohibition of offshore exploration, including an indefinite moratorium, which remains in effect, in waters lying south of Telegraph Cove at the northern end of Vancouver Island.

Jurisdiction

The joint review is being conducted without prejudice to government ownership and jurisdiction of offshore resources.

Permits

Companies holding federal exploration permits in the area when the moratorium was imposed were Douglas Fletcher Smith (1 186 455 hectares), Shell

Canada Resources Limited (4 967 435 hectares), Ranger Oil Limited (79 680 hectares), Lochiel Exploration Ltd., (98 420 hectares) and Union Oil Company of Canada Limited (45 440 hectares). Chevron Canada Resources Limited is the operator on the Smith and Shell permits.

Petro-Canada Inc. negotiated three exploration agreements with the Government of Canada effective January 15, 1982, for 2 358 345 hectares in the area under review. There are no active provincial permits in the area.

Environmental Review

Chevron Canada Resources Limited and Petro-Canada Inc., the two companies that have expressed an interest in resuming exploration off the West Coast, have, at the request of the federal government, completed Initial Environmental Evaluations (IEEs) for their areas of interest. The IEEs, together with the Preliminary Environmental Assessment (PEA) carried out by the B.C. Ministry of Environment, will form the basis for the review. The PEA is now public information. Petro-Canada's IEE has been received by both governments and is available from the company. Chevron's IEE will be released later this month.

The panel will operate under the joint framework to be established under the provincial Environmental Management Act and the Federal Environmental Assessment and Review Process.

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CONFIDENTIAL

83/97 (b)

MEMORANDUM OF AGREEMENT

BETWEEN: THE GOVERNMENT OF CANADA AS REPRESENTED BY THE MINISTER OF ENERGY, MINES AND RESOURCES

AND: THE GOVERNMENT OF BRITISH COLUMBIA AS REPRESENTED BY THE MINISTER OF ENERGY, MINES AND PETROLEUM RESOURCES

JOINT CANADA-BRITISH COLUMBIA ENVIRONMENTAL REVIEW OF THE ASSESSMENT OF EFFECTS OF OFFSHORE PETROLEUM EXPLORATION

1. This agreement is without prejudice to resource ownership or jurisdiction; to any future agreement which may be reached respecting offshore resource management; and to any future agreement which may be reached on sharing of revenues from offshore oil and gas activity. It does not extend to the regulation of exploration, should there be a decision to proceed with exploratory drilling activity, nor to the development and production phases of oil and gas activity.

2. The federal Minister of Energy, Mines and Resources (EMR) and the provincial Minister of Energy, Mines and Petroleum Resources (EMPR) agree to cooperate in a joint process for the review of environmental and related socio-economic impact assessment, including a public review, concerning the implications of oil and gas exploration activities in the area seaward of the low water mark to the limit of the continental rise, between 50° 40'N and 54° 40'N shown as the "agreement area" in Schedule 1. The object of this process will be to recommend the terms and conditions under which exploration might proceed in a safe and environmentally responsible manner, should a decision be made to resume exploratory drilling activity.

3. The federal Department of EMR and the provincial Ministry of EMPR will invite Chevron Canada Resources Limited and Petro-Canada Inc. to submit their Initial Environmental Evaluations (IEES) to both departments, and will invite the British Columbia Ministry of Environment to submit its Preliminary Environmental Assessment (PEA) to both departments. The studies will be made available as soon as feasible after this Agreement is signed.

4. Following submission and release of the IEEs and PEA, they will undergo a technical evaluation in order to assess the data base and to identify issues related to the environmental and related socio-economic implications of oil and gas exploration. This technical evaluation, a prelude to a formal public review, will be coordinated by the federal Department of EMR and the provincial Ministry of EMPR, in close collaboration with the federal Departments of Environment, and Fisheries and Oceans, and the provincial Ministry of Environment. As part of the evaluation, it is planned that the three studies will be the subject of a technical review at a workshop in early October in Vancouver, to be convened jointly by the federal Department of EMR and the provincial Ministry of EMPR.

5. Following the technical evaluation, the formal public review process will be established and conducted in accordance with terms of reference prepared jointly by the federal Department of EMR, in consultation with the Federal Environmental Assessment Review Office (FEARO), and the provincial Ministry of EMPR, in consultation with the provincial Ministry of Environment, within the framework set out in Schedule 2. These terms of reference will accompany the initiation of the formal public review following the technical evaluation. Detailed procedures for the conduct of the formal public review will be established by the review panel in accordance with the terms of reference.

6. There will be an approximately equal sharing of agreed joint public review costs, i.e. direct administrative and secretariat costs. This does not extend to related activities or studies that either government might wish to initiate, or to studies that the review might recommend. This Agreement does not encompass intervenor funding.

7. The federal Department of EMR and the provincial Ministry of EMPR will consult closely on other matters related to the joint process for environmental and related socio-economic impact assessment, such as information programs. These activities may be incorporated into this Agreement and undertaken jointly within the terms of this Agreement by mutual agreement at a later date.

IN WITNESS WHEREOF, the representatives of the parties hereto have executed this Memorandum of Agreement this 8th day of September 1983.

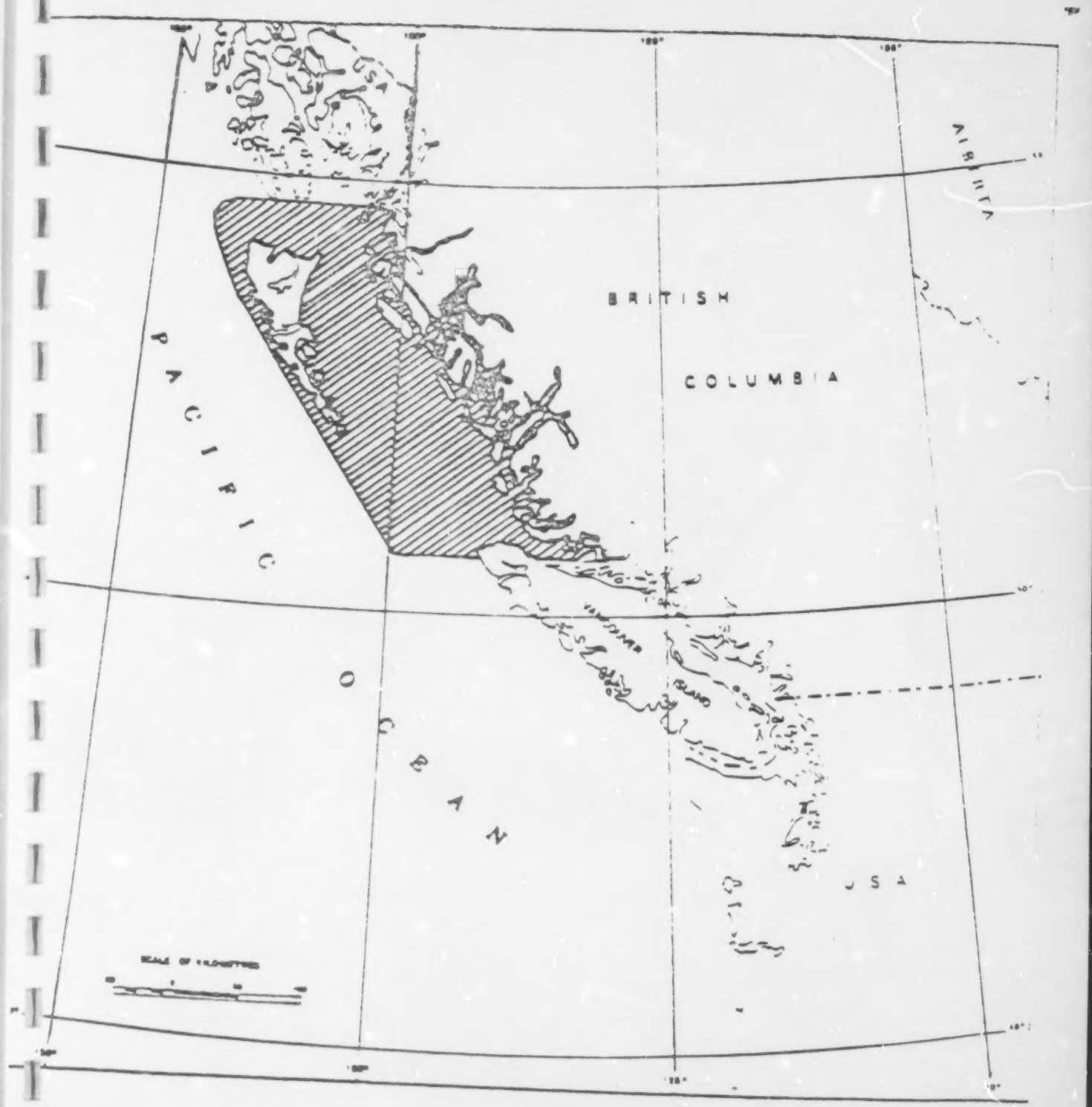
_____

The Minister of Energy, Mines and Resources
for the Government of Canada

_____

The Minister of Energy, Mines and Petroleum Resources
for the Government of British Columbia

SCHEDULE I



SCHEDULE 2

T CANADA-BRITISH COLUMBIA ENVIRONMENTAL EVIEW OF THE ASSESSMENT OF EFFECTS OF OFFSHORE PE ROLEUM EXPLORATION: TERMS OF REFERENCE FRAMEWORK

The federal Minister of EMR and the provincial Minister of EMPR will request the federal Minister of Environment and the provincial Minister of Environment, respectively, to establish a formal public review of the environmental and related socio-economic implications of offshore petroleum exploration.

There will be five panel members, mutually agreed on by both governments; two of whom will be appointed by the federal Minister of Environment, two by the provincial Minister of Environment, and one, appointed by both Ministers, who will be designated chairperson. The terms of appointment and budget, which will be developed, will serve to provide both an indicative time framework and a limit on expenditures.

The appointed review panel is to recommend proposals regarding the terms and conditions under which exploration might proceed in a safe and environmentally responsible manner, should a decision be made to resume exploratory drilling activity. The review will be conducted without prejudice to any jurisdictional claims by either government to the ownership of offshore petroleum resources.

It is understood by both parties that since the Province of British Columbia has not issued exploration permits in the offshore, it will, for the purpose of this Agreement, accept the holders of federal permits, Petro-Canada Inc. and Shell Canada Resources/Chevron Canada Resources Limited, as companies designated to present environmental evaluations.

The review will be conducted with the understanding that a further public review will be held, if a commercial discovery is made and there is a proposal for development.

The IEEs and the PEA are to be considered the main source documents for the review. They will be complemented by other review requirements (e.g. impact identification and mitigative measures) that will be met, and with these constitute an Environmental Impact Statement.

1. Proposed Activity

A determination of the nature and extent of proposed activity will be undertaken, including consideration of the offshore geology and hydrocarbon potential to the extent that it indicates likely areas of interest for exploration activity.

2. Activities Associated with Exploration

The range of activities associated with exploration will be identified and assessed with the intention of recommending the appropriate terms and conditions to ensure safe and environmentally secure operations. This could include consideration of exploration methods and potential risks and the possible impact of exploration activity.

3. Offshore Effects

The review will examine the potential effect of exploration activity on the conditions, resources and other uses (e.g. commercial and Indian fisheries, and recreational uses) of the marine environment. It will also assess the potential effect of the marine environment on proposed exploration activity. The review will include an examination of the adequacy of the existing information base, an assessment of potential environmental effects and the possibilities for the mitigation of their impact.

4. Onshore Effects

The review could consider new land-based support activities, if any are proposed, which would be directly associated with offshore petroleum exploration. This will include potential environmental and socio-economic effects, both direct and indirect, of exploration activity on coastal communities, and the means, where effects are detrimental, for their mitigation.

5. Report and Recommendations

The review panel will submit a report of its findings to the Ministers of Environment for British Columbia and for Canada. The report will include proposals on the terms and conditions, under which petroleum exploration might proceed in a safe and environmentally responsible manner, should a decision be made to resume exploratory drilling activity.

APPENDIX B

WORKSHOP PARTICIPANTS

Workshop Participants

Geology Coastal Geomorphology & Seismicity

Moderator - Graham R. Campbell - Canada Oil and Gas Lands Administration

Rapporteur - Walter Young - B.C. Ministry of Energy, Mines and Petroleum Resources

Participants

Energy, Mines and Resources Canada

Garry C. Rogers
Brian Cook
B. D. Bornhold
R. A. Edwards
P. McLaren

Canada Oil and Gas Lands Administration

Leo Brandon

Environment Canada

John Millen
Bob Sherwood

B.C. Ministry of Energy, Mines and Petroleum Resources

J. A. Hudson
D. J. Stewart

B.C. Ministry of Environment

Barney Lane

B.C. Ministry of Lands, Parks & Housing

Tom Cockburn

Resource Personnel

Don Karasiuk - Petro-Canada, Inc.
W.R. Maiklen - Petro-Canada, Inc.

John R. Harper - Chevron Canada Resource Ltd.
Dave Organ - Chevron Canada Resource Ltd.

Oceanography & Meteorology

Moderator - Ken Sato - Canada Oil and Gas Lands Administration

Rapporteur - Jim Slater - B.C. Ministry of Environment

Participants

Energy, Mines and Resources Canada

Brian Cook

Fisheries & Oceans Canada

A. F. Giovando
Dick Herlinveaux

Transport Canada

David J. Brenner
M. A. Turner

Environment Canada

H. T. Beal
Bob Sherwood

B.C. Ministry of Environment

Joe Negraeff

Resource Personnel

W. C. Thompson - Petro-Canada, Inc.
Brad Muir - Petro-Canada, Inc.
Joe Buckley - Petro-Canada, Inc.

Ernest Cudby - Chevron Canada Resource Ltd.
Dave Miles - Chevron Canada Resource Ltd.
Ron Richardson - Chevron Canada Resource Ltd.

Plankton, Fish & Benthos

Moderator - Mike Flynn - Fisheries & Oceans Canada

Rapporteur - Don Tillapaugh - B.C. Ministry of Environment

Participants

Fisheries & Oceans Canada

Colin Levings
J. Mason
C. McAllister
Alan Cornford
Dennis Rowse

Environment Canada

Lee Harding

B.C. Ministry of Environment

John Ward
Bob Langford
L. M. Coon

Resource Personnel

Michael Robertson - Petro-Canada, Inc.

Tim Hollibaugh - Chevron Canada Resources Ltd.

Birds & Mammals

Moderator - Rainer Engelhardt - Canada Oil and Gas Lands Administration

Rapporteur - Gary Kaiser - Environment Canada

Participants

B.C. Ministry of Environment

Doug Morrison
Alan Eadie
Umeeda Umedaly

B.C. Ministry of Lands, Parks & Housing

Jim Cockburn

Environment Canada

Kees Vermeer

Fisheries & Oceans Canada

Mike Bigg (call-in)
Brian Smiley

Resource Personnel

Sarah Groves - Chevron Canada Resource Ltd.
Tom Reeson - Chevron Canada Resource Ltd.
John Foster - Chevron Canada Resource Ltd.
Ted Spearing - Chevron Canada Resource Ltd.

Wayne Speller - Petro-Canada, Inc.

Socio-Community

Moderator - Beth Carter - B.C. Ministry of Industry and Small Business Development

Rapporteur - Jean Hnytka - B.C. Ministry of Environment

Participants

B.C. Ministry of Municipal Affairs

Tom Maftechuk

B.C. Ministry of Transportation & Highways

Mike Kent

B.C. Ministry of Lands, Parks & Housing

Karen Koncohrada

B.C. Ministry of Education

Gary Bunney

B.C. Ministry of Energy, Mines & Petroleum Resources

Don MacMillan

B.C. Ministry of Attorney General

Gareth Davies

Employment & Immigraton Canada

Linda Farris

Resource Personnel

Alun Richards - Petro-Canada, Inc.

Leo Zerr - Chevron Canada Resources Ltd.
Charlie Stewart - Chevron Canada Resources Ltd.

Socio-Economic

Moderator - Carol Shaw - B.C. Ministry of Industry and Small Business Development

Rapporteur - Eric Val - Canada Oil and Gas Lands Administration

Participants

B.C. Ministry of Industry and Small Business Development

Tom Santosham

B.C. Ministry of Energy, Mines & Petroleum Resources

Gerald German

B.C. Provincial Secretary

Brian Apland

B.C. Ministry of Labor

Bob Pfister

B.C. Ministry of Lands, Parks & Housing

Eman Khan

Fisheries & Oceans Canada

Lawrence Evans

Employment & Immigration

Bob Van Tongerloo
Bob Irwin

Ministry of State Economic & Regional Development

John Hansen

Resource Personnel

Doug Bruchet - Petro-Canada, Inc.
Mike Robinson - Petro-Canada, Inc.

Carl Young - Chevron Canada Resources Ltd.
Bob Dryden - Chevron Canada Resources Ltd.
Derek Ireland - Chevron Canada Resources Ltd.

APPENDIX C

GOALS AND OBJECTIVES

OF

TECHNICAL EVALUATON

TECHNICAL EVALUATION
OFFSHORE HYDROCARBON EXPLORATION

January 17-18
Pacific Marine Sciences Institute
Sidney, B.C.

Purpose

The purpose is to carry out a technical evaluation of the Initial Environmental Evaluations prepared by Chevron and Petro-Canada in support of renewed hydrocarbon exploration. These Initial Environmental Evaluations are expected to include a description of the project, a description of the current environment and resource use, an outline of the potential environmental effects and impacts, and their significance, and the details of the measures proposed to mitigate or prevent anticipated environmental effects. They should also provide a judgement on the impact of the effects remaining after all known measures for prevention and counteraction have been specified. As appropriate, the IEEs should examine alternate ways of accomplishing the project and should identify the preferred alternative(s).

In reviewing the IEEs, participants will be asked to consider the following questions:

1. Have the known generic effects of seismic and exploration activities been characterized? For example, the known effects of hydrocarbons on fish plankton, sea birds, etc.
2. Have those elements of the environment which are identified in question 1., to be potentially effected by hydrocarbon activity, been adequately described for the Queen Charlotte Sound, Hecate Strait, Dixon Entrance areas?
3. Have the levels of impact on the environment identified in question 2 been adequately evaluated? For example, were the assumptions leading to a prediction of levels of impact reasonable?
4. What are the information gaps and how might planning accommodate the existence of those gaps?
5. Do the IEEs adequately assess the scale and probability of accidental occurrences?
6. Do the IEEs provide an adequate description of measures, abatement practices, contingency plans, operational practices or other means to control and abate deleterious effects from accidental or routine occurrences? and,
7. Any other such related questions as may be put before the Technical Evaluation by the coordinators.

Participants

Participation is by invitation to persons with defined expertise from federal and provincial agencies, the designated companies and invited non-government participants. Because of limitations of facilities, review participation will be limited to named participants.

Logistics

The Technical Evaluation will take place at the Institute of Ocean Sciences, Sidney, B.C., 30 kilometers north of Victoria, British Columbia. To facilitate out-of-town participants a block of rooms has been reserved at the Royal Oak Inn. A bus will provide scheduled transporation between the hotel and the Institute. A buffet dinner at Periklis Restaurant is being arranged for the evening of January 17 at a cost of $15/person. For information contact:

Lynne Ewing
Petroleum Resources Division
Ministry of Energy, Mines
and Petroleum Resources
Victoria, B.C.
Telephone: 387-5178

Duncan Hardie
Canada Oil and Gas
Lands Administration
Ottawa, Ontario

Telephone: (613) 993-3760

Format

The program for each day will be convened by Dr. Maurice Ruel (COGLA) and Dr. Bob Durie (MEMPR). Workshop sessions will be led by a moderator and proceedings will be recorded by a rapporteur. The moderators and rapporteurs will be responsible for summarizing the proceedings and conclusions of their workshop group. Participants will be divided into workshop groupings under the following categories:

1. Physical - Geology, Seismicity, Oceanography and Meteorology
2. Biological - Plankton, Fish and Benthos
3. Biological - Birds and Mammals
4. Socio-Community - Community, Services, Infrastructure
5. Socio-Economic - Fisheries, Tourism, Industry

Program

Resolutions on the scope of responsibilities for each workshop will be determined at a meeting prior to the Technical Evaluation. However, each workshop will be asked to respond to the six questions listed.

APPENDIX D

RESOURCE PERSONNEL

Resource Personnel & Observers

B.C. Ministry of Energy, Mines & Petroleum Resources

Bob Durie
Wilf Quinn
Lynne Ewing

B.C. Ministry of Environment

Jon Secter
Bob Langford
Bill Wolferstan

Canada Oil and Gas Lands Administration

Maurice Ruel
Duncan Hardie

Fisheries & Oceans Canada

A. Cornford
C. McAllister

Federal Environmental Assessment Review Office

Paul Scott
Barry Sadler

Petro-Canada, Inc.

Gerry Glazier
Fred Calverly
Peter Kay
Wishart Robson
Michael Robertson

Chevron Canada Resources Ltd.

Tim Hollibaugh
John McDonald
Carl Bonke (Shell)